Space Weather Technical Forecast

Issued on Friday, 28 January 2022 at 00:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance G1/Minor Geomagnetic Storm, mainly today or tomorrow (28th or 29th). Slight chance R1 Radio Blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low through the last 24 hours, with five numbered sunspot regions on the visible disc, plus two new and un-numbered regions and two areas of plage. Despite AR2936 (Dai/beta) remaining the largest and most complex region on the visible disc it only generated a B9 flare, compared to a C1 flare from AR2938 which has the simpler classification of Bxi/beta. These regions are in the northeast quadrant. There are three small regions in the northwest, AR2935 (Axx/alpha) plus the two un-numbered small and simple regions. AR2934 (Hsx/alpha) and AR2937 (Cro/beta) are located in the southwest quadrant. No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1 has fluctuated between 440-500 km/s. The density was predominantly at average levels, but temporarily reached above average levels through the afternoon. The total field strength (IMF) Bt, varied 3-9nT. The north-south component, Bz, remained weak and variable ranging between +5nT and -5nT. Phi angle was generally positive (away from the Sun), but with some brief negative fluctuations. Geomagnetic Activity remain Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2MeV), was at background to moderate levels, peaking at 379 pfu at 27/1735 UTC. The associated electron fluence was below the Active threshold (1e8 integrated flux), with 4.61e6 recorded at 28/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to remain predominantly Low. There are five numbered sunspot regions on the Earth-facing disc, with a slight chance of M-class flares, primarily from AR2936 and AR2938, both in the northeast.

Solar Wind / Geomagnetic Activity: There is one CME on the Earth-Sun line that has been assessed, but currently expected to pass close to Earth around 29/0000 UTC, although a glancing impact is possible. A further weak CME may brush Earth on the 30th, but this is lower confidence. Between the potential CME arrivals, and also the influence of a slight enhancement from CH47 through today, solar winds are expected to be slightly elevated to elevated, likely peaking around around 550km/s, before gradually easing to become background to slightly elevated levels through day 4 (31st). Geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3) increasing occasionally Active (Kp 4) today, tomorrow and during day 3 (30th) with a slight chance of G1/Minor Storm (Kp 5) intervals

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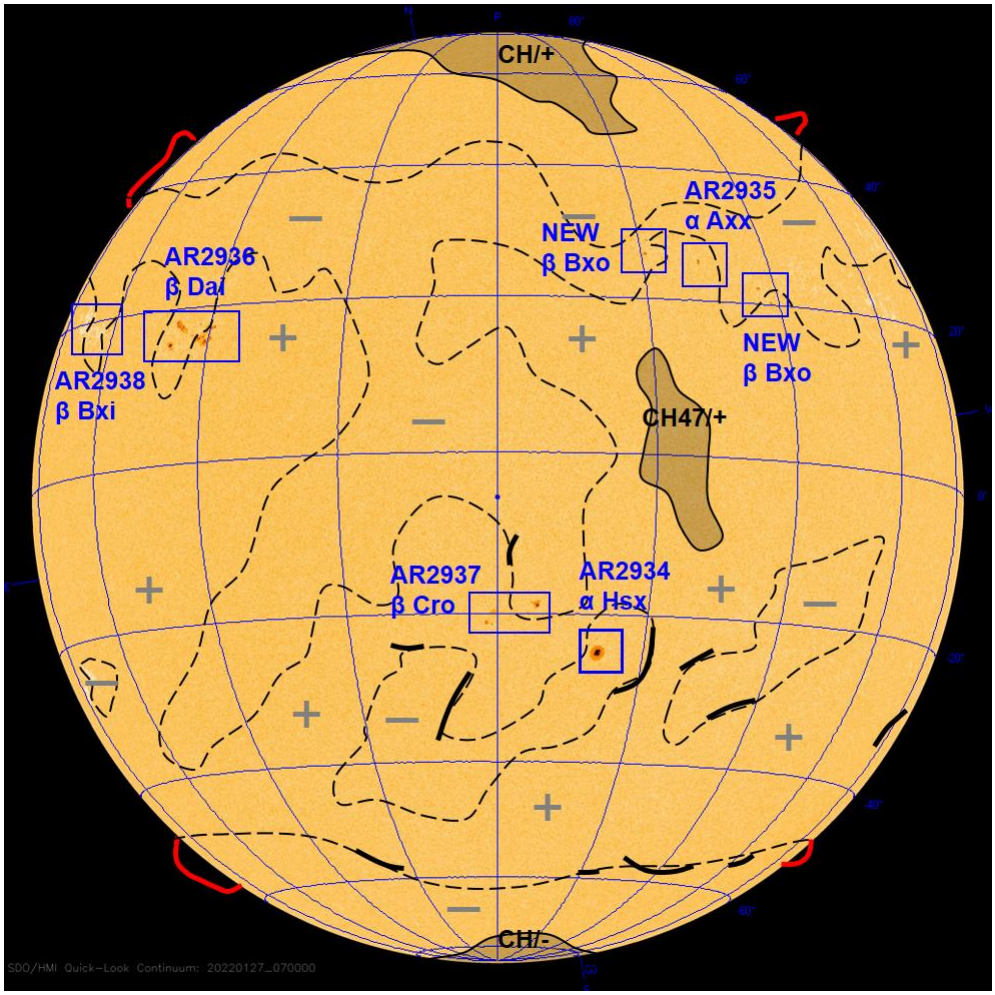
Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is forecast to remain at background levels. The high energy electron flux (greater than 2MeV) is expected to remain at predominantly background to moderate levels, but with an increasing chance of high levels being reached at the peak of the diurnal cycles, especially during days 3 and 4 (30th and 31st). The associated 24hr fluence is expected to remain below the Active threshold, despite an increasing trend.

Figure 1. Solar Analysis Valid 27/1930 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There is one CME currently expected to pass near Earth during the forecast period, however the bulk of this CME is forecast to miss passing north of the Earths orbital plane. This was from a filament eruption on the 24th, potentially associated with a C2-flare. This has a chance of glancing influence around 29/0000UTC. A filament eruption at 26/1945 UTC, from near AR2934, has been modelled and could give an Earth-directed glance on the 30th, although this is low confidence.

Between the potential CME arrivals, and also the influence of a slight enhancement from CH47 through today, solar winds are expected to remain slightly elevated to elevated, likely peaking around 550km/s, before gradually easing to become background to slightly elevated levels through day 4 (31st). This is in-line with expectations from persistence, and also timings of an enhancement seen in STEREO A PLASTIC data, although this is contaminated with a CME arrival.

Geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3) increasing occasionally Active (Kp 4) today, tomorrow and during day 3 (30th) with a slight chance of G1/Minor Storm (Kp 5) intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
25/0220	Partial	Filament	N23 E001	376	29/0000 UTC	Glancing blow
27/0501	Partial	Filament	S23W12	411	30/1200 UTC	Very low confidence of any impacts

Figure 2: Met Office ENLIL ensemble indicating the potential arrival of a CME later today, and to a lesser extent a weak CME arrival on the 30th.

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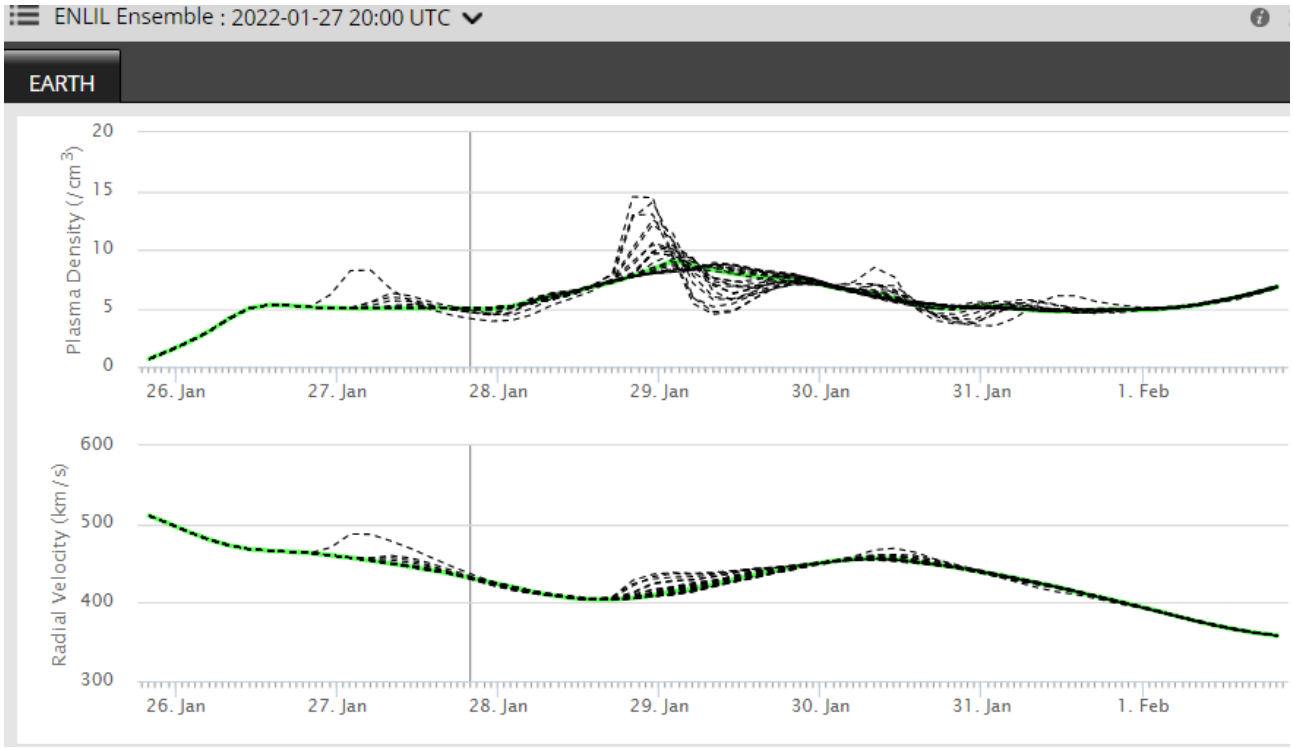

Radio Blackouts - X-Ray Flares:

Solar Activity has been Low. There are five numbered sunspot regions, and AR2936 remains the largest and most complex (Dai/beta), with further intermediate and lead spot development observed. All the remaining regions on the visible disc are magnetically simple, mostly weak, small and stable. However, despite having barely visible spots AR2938 (Bxi/beta) produced the only C-class flare during the previous 24 hours. Two un-numbered spot regions persist in the northwest quadrant, unchanged as small and weak Bxo groups, along with two areas of plage on the visible disc.

Low solar activity is expected to continue, with a slight chance of isolated M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux, as measured by GOES-16 is at background levels. No solar radiation storms are expected in the period.

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Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

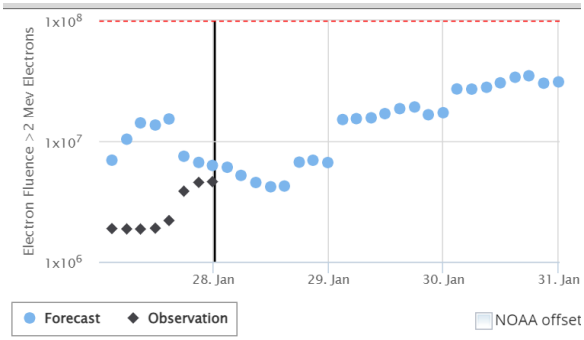
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) as observed by GOES-16 at GEO, was at background to moderate levels, peaking at 379 pfu at 27/1735 UTC.) during the previous 24 hours. The high energy electron flux is expected to remain at predominantly background to moderate levels, but with an increasing chance of high levels being reached at the peak of the diurnal cycles, especially during days 3 and 4 (30th and 31st).

With only a limited flux response anticipated from either fast wind enhancement, the associated 24hr fluence is expected to remain below the Active (1e8 integrated pfu) level despite an increasing trend. The Met Office REFM supports fluence levels remaining below the Active period, and is considered to be giving good guidance at this stage.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	10	20	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Met Office REFM model.



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